Natural fibre-reinforced plastics: establishment and growth in niche markets

More than 30 compound companies produce over 80,000 tonnes of granulates with wood and natural fibres in Europe 2017 – new producers with major growth plans

Authors: Michael Carus and Dr. Asta Partanen (nova-Institute)

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There are many reasons to fill or reinforce plastics with wood or natural fibres of all kinds. Optical and haptic reasons play a role when it comes to differentiating products from standard plastic products. Especially in household goods, consumer goods and toys attributes like optics, haptics and a green image are important considerations. Weight savings, reduction of primery energy, shorter cycle times, scratch resistance and a lower CO_2 footprint play a crucial role in technical applications and in the automotive industry. And, in combination with biodegradable plastics, products are also manufactured for packaging, agriculture and horticulture as well as for special applications such as filter balls and coffee capsules.

Today, in addition to experienced component manufacturers who have been offering a wide variety of biocomposites for years, there are new suppliers on the market who want to use innovative technologies to produce and market even better granulates.

Over 30 compound producers from Europe offer hundreds of recipes

In total, more than 30 compound producers from Europe with different polymers and natural fibres are currently producing several hundred recipes. Common petrochemical plastics are PP, PE, PVC and TPE/TPS. More and more often biopolymers such as Bio-PE, PLA, PBS, PBAT or PHA are used. Depending on the target application, natural fibres also contain wood flour, wood fibres, cellulose fibres, bast fibres such as hemp, flax, jute or kenaf, but also bamboo, cork or the fibres of the sunflower seed shells. The fibre content for injection moulding granulates is usually between 20% and max. 50%, with extrusion contents of up to 80% are possible. At Fakuma in Friedrichshafen, Germany, the world‘s largest plastics and granulate trade fair, more than 20 exhibitors offering biocomposites were among the nearly 1,900 exhibitors in October 2017.

The following table tries to list the most important European suppliers of wood and natural fibre filled and reinforced plastic granulates with their production quantities in 2017. Only a few manufacturers are able to produce and sell quantities of 10,000 t per year or more. The largest producer is the Portuguese company Amorim with its cork granulates, which are used in shoe soles, handles and even in space travel. Many producers are still below 1,000 t/year or even only 500 t/year, although some of them, marked in the table with „NEW“, have very substantial growth plans. Over the next few years, additional capacities of more than 50,000 to 300,000 tonnes are planned to be built. This estimation might not be unrealistic as quality and prices have improved steadily over the last few years and many granulates have an attractive price-performance ratio today.

On the other hand, new producers have not succeeded in establishing quantities of more than 20,000 or even 50,000 t/year on the market in recent years. For this reason, some players have withdrawn from the market (Borealis, A. Schulman), while others have corrected their plans downwards significantly (Mondi, PolyOne, UPM).

Major producers and suppliers of wood and natural fibre filled and reinforced plastic granulates with their production quantities in Europe in 2017

Granulate Producer	Country	Polymers	Fibres	Production range 2017 in tonnes
AMORIM	PT	PP, TPE/TPS	Cork	20,000 – 50,000
Beologic	BE/AT	ABS, PC, PE, PHA, PHB, PLA, PMMA, PP, PS, PVC, SAN, TPE	Wood and natural fibres and others	10,000 – 20,000
Tecnaro	DE	Lignin, PE, PP, PLA, PP, PBS, PBAT	Wood and natural fibres	5,000 – 10,000
Advanced Compounding	DE	PA, PE, PP	Wide range of natural fibres	1,000 – 5,000
Golden Compound	DE	PP, Biopolymers	Fibres from sun flower shells	1,000 – 5,000
Jelu Werke	DE	PP, Biopolymers	Wood and natural fibres and others	1,000 – 5,000
Pinuform	DE	PE	Wood	1,000 – 5,000
Plasticwood	IT	PP	Wood	1,000 – 5,000
Biowert	DE	PE, PP, PLA	Grass fibres, flax	500 – 1,000
FKuR	DE	Bio-PE, Bio-TPE, PHA, PLA, PP	Bamboo, wood, corc	500 – 1,000
Hexpol	SE	TPE	Cork	500 – 1,000
Rhenoflex	DE	Polyester, PLA, PP, TPU	Corn cob, wood, rice husks, straw	500 – 1,000
UPM	FI	PP	Cellulose fibres	500 – 1,000
Werzalit	DE	PP	Wood	500 – 1,000
Addiplast	FR	PP	Wood and natural fibres, cellulose fibres	< 500
Aqvacomp	FI	PP	Cellulose fibres	< 500 NEW
Biofribre	DE	PBS, PLA	Wood, natural fibres	< 500 NEW
GreenGran	NL	PP, biopolymers	Natural fibres	< 500
HempFlax	NL	PP, PLA	Natural fibres	< 500 NEW
Linotech	DE	PP, PLA	Wood and natural fibres	< 500
Mondi Paper	AT	PP	Cellulose fibres	< 500
PolyOne	USA/EU	PP	MDF wood fibre	< 500
Sappi	SA/DE	PP	Cellulose	< 500 NEW
Transmare	NL	PP, PLA	Wood, bamboo and natural fibres	< 500
Total	**EU**			**80,000**

Number of applications and total production continues to rise steadily

Overall, it is clear that the number of applications and total production are increasing, but growth rates are lower than expected and total volumes are only slowly moving into larger dimensions.

The nova-Institute's current estimate is around 80,000 tonnes of natural fibre granulates produced and traded in Europe in 2017, which would mean a doubling compared to 2012. However, it may take a few more years before quantities of several hundred thousand tonnes are reached.

The following examples illustrate the ongoing establishment of the market as well as a large number of new, attractive applications.

IKEA (Sweden) has reintroduced the WPC chair "PS 2012", but now with a significantly improved WPC granulate (Wood-Plastic Composite). In addition, the company also offers other products made of wood-plastic composites, including picture frames and another chair "ODGER" made of a wood-plastic composite. The special feature of this chair is that no tools are required to assemble the chair – the seat and base are easily assembled by a simple mechanism below the seat. The chair's matrix material is a recycled plastic material. The use of recycled polymers in European biocomposite production has increased, especially in extrusion and decking area, but also in injection moulding.

There is also a new application in the consumer electronics sector – in a product group where acoustic properties are key to success. With LG Electronics using the cellulose-based granulate Aqvacomp, for the first time one of the market leaders utilizes a biocomposite material for the production of speaker cabinets. The unique and patented AqvacompTM "wet-mixing" compounding process creates composite with excellent strength to density ratio. The material shall also be used in the automotive industry in the future. The cellulose-based granulates from the South African company Sappi are also targeting this market.

Advanced Compounding from Germany produces naturally antibacterial granulates made of PLA and pine wood, which are used for door handles and toys. Other innovations include the use of pine chips in industrial bread baskets and antibacterial packaging for shampoo bottles. Mock brings its new grain mill „Mockmill 100" with a casing made of Tecnaro's PP-wood granulate to the market. Until now, Mock has not used any plastics for its casings, but only wood.

The Belgian compounder Beologic demonstrated the use of recycled materials at Fakuma in form of flower pots made of recycled denim fibres and also as wine coolers and crates for grape harvest made of grapevine granulates. For 3D printing, the use of biocomposites in 3D fused layer modelling offers interesting optical and haptic effects. For example, FKUR and UPM offer materials for this application area. 3D printing has recently been used in modern architecture in large buildings to offer completely new design possibilities. Further information can be found in the conference proceedings of the 7th Biocomposite Conference Cologne: All presentations can be ordered at the price of 150 €: www.bio-based.eu/proceedings".

The total European biocomposite production reached 410,000 tonnes in 2017. Yearly growth rate is 3% – highest growth rate of 30% found in innovative fields ranging from technical applications over furniture up to consumer goods

The total biocomposite production in Europe is estimated to amount to 410,000 tonnes in 2017, compared to 357,000 tonnes in 2012 (see table). The overall annual growth rate of the European biocomposite production is about 3%, which is roughly in line with the average growth of the plastics market. But much higher growth rates of up to 30% have been identified in various innovative application fields of biocomposites. These application fields range from technical applications over furniture to consumer goods that are produced mainly with injection moulding, 3D and other production methods like rotomoulding as well as foaming of biocomposites that creates new opportunities as well in extrusion as in injection moulding. Furthermore, in the area of traded granulates the overall growth rate has also been subsantially higher as the average (15%). The partial or complete replacement of petroleum-based products with bio-based materials and composites has been underway for years, and market areas and applications are increasing. Voume-wise, development is still on the way to higher dimensions.

Biocomposites (NFC, WPC & others)	2012	2017	CAGR in % from 2012 to 2017
Decking, siding and fencing, mainly extrusion	190,000	200,000	1
Automotive, mainly compression moulding	150,000	150,000	0
Technical applications, furniture and consumer goods, mainly injection moulding, 3Dand others	17,000	60,000	29
Total	**357,000**	**410,000**	**3**
The total figure includes: Produced and traded granulates or injection moulding and extrusion	*40,000*	*80,000*	*15*

More information on fibre reinforced plastics:

Wood-Plastic Composites (WPC) and Natural Fibre Composites (NFC): European and Global Markets 2012 and Future Trends in Automotive and Construction, nova-Institute 2015, available at *www.bio-based.eu/reports*

BIOVERBUNDWERKSTOFFE: Naturfaserverstärkte Kunststoffe (NFK) und Holz-Polymer-Werkstoffe (WPC), nova-Institute 2018, available at *www.bio-based.eu/markets*

Suppliers for NFC, WPC and more can be found at International Directory for Bio-based Businesses *www.bio-based.eu/ibib*

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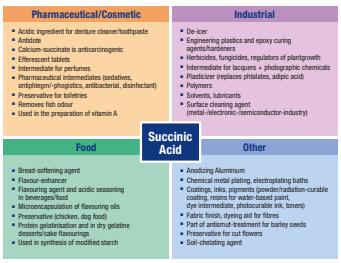

Authors: Raj Chinthapalli, Kerstin Iffland, Florence Aeschelmann, Achim Raschka, Michael Carus, nova-Institut GmbH, Germany
February 2018

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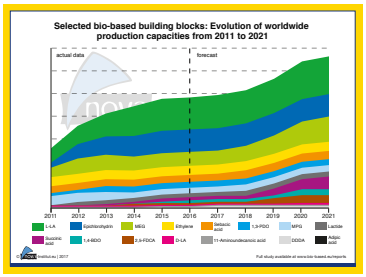

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Authors: Lara Dammer, Michael Carus and Dr. Asta Partanen
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May 2017

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E-mail: j.ravenstijn@kpnmail.nl
Mobile: +31.6.2247.8593

Author: Jan Ravenstijn, Jan Ravenstijn Consulting, the Netherlands
April 2017

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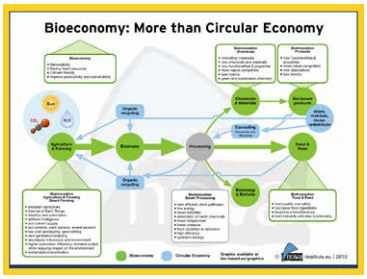

Authors: Dirk Carrez, Clever Consult, Belgium
Jim Philp, OECD, France
Dr. Harald Kaeb, narocon Innovation Consulting, Germany
Lara Dammer & Michael Carus, nova-Institute, Germany
March 2017

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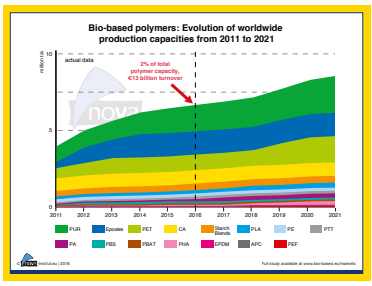

Authors: Florence Aeschelmann (nova-Institute),
Michael Carus (nova-Institute) and ten renowned international experts
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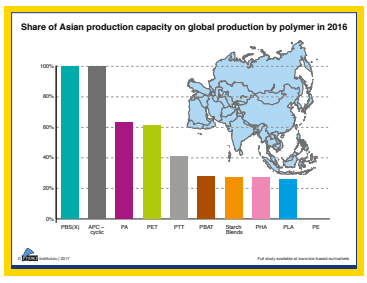

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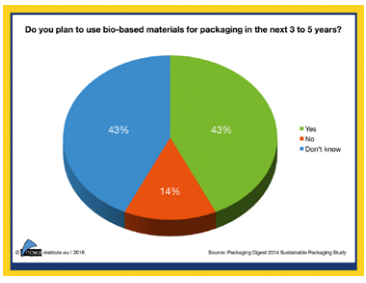

Author: Dr. Harald Kaeb, narocon Innovation Consulting, Germany
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Authors: Harald Kaeb (narocon, lead), Florence Aeschelmann, Lara Dammer, Michael Carus (nova-Institute)

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